

A REVISED KEY TO THE AUSTRALIAN GENERA OF MATURE MAYFLY (EPHEMEROPTERA) NYMPHS

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Summary

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A revised, illustrated generic key to mature nymphs of the Ephemeroptera (mayflies) of Australia is presented. A résumé of diagnostic characters of the five families represented in Australia is also given, and a list of the 19 genera described from Australia is included.

Introduction

Although the Ephemeroptera, or mayflies, are abundant in the Australian freshwater environment, their classification below the level of Family is unreliable. The majority of the systematic study on this Order has been concerned with the adult stage, with approximately 70 species being described. Of these species only 33 have been associated with their respective nymphs. This situation, although similar to that found in the rest of the world (Edmunds & Allen 1966), is anomalous in that nymphs are by far the longest living stage, and they are often abundant in benthic samples from permanent freshwater habitats. The inability to identify animals abundant in the benthos limits the amount of information that is available on the benthic community.

Williams (1968) recognised this problem and provided a key to the genera of Ephemeroptera nymphs, noting that some difficulties would occur in its use. After examining numerous collections of nymphs and adults, from all parts of Australia, a revision of Williams' key to genera has been prepared. Comments and criticisms from biologists upon this revision will enable further improvements to be made, resulting in reliable identification.

There has been debate about the classification of this Order, especially of the families Baetidae and Siphonuridae. Riek (1970) placed the two groups as subfamilies Siphonurinae and Baetinae in the Baetidae. In 1973, Riek refers to the Siphonuridae and Baetidae

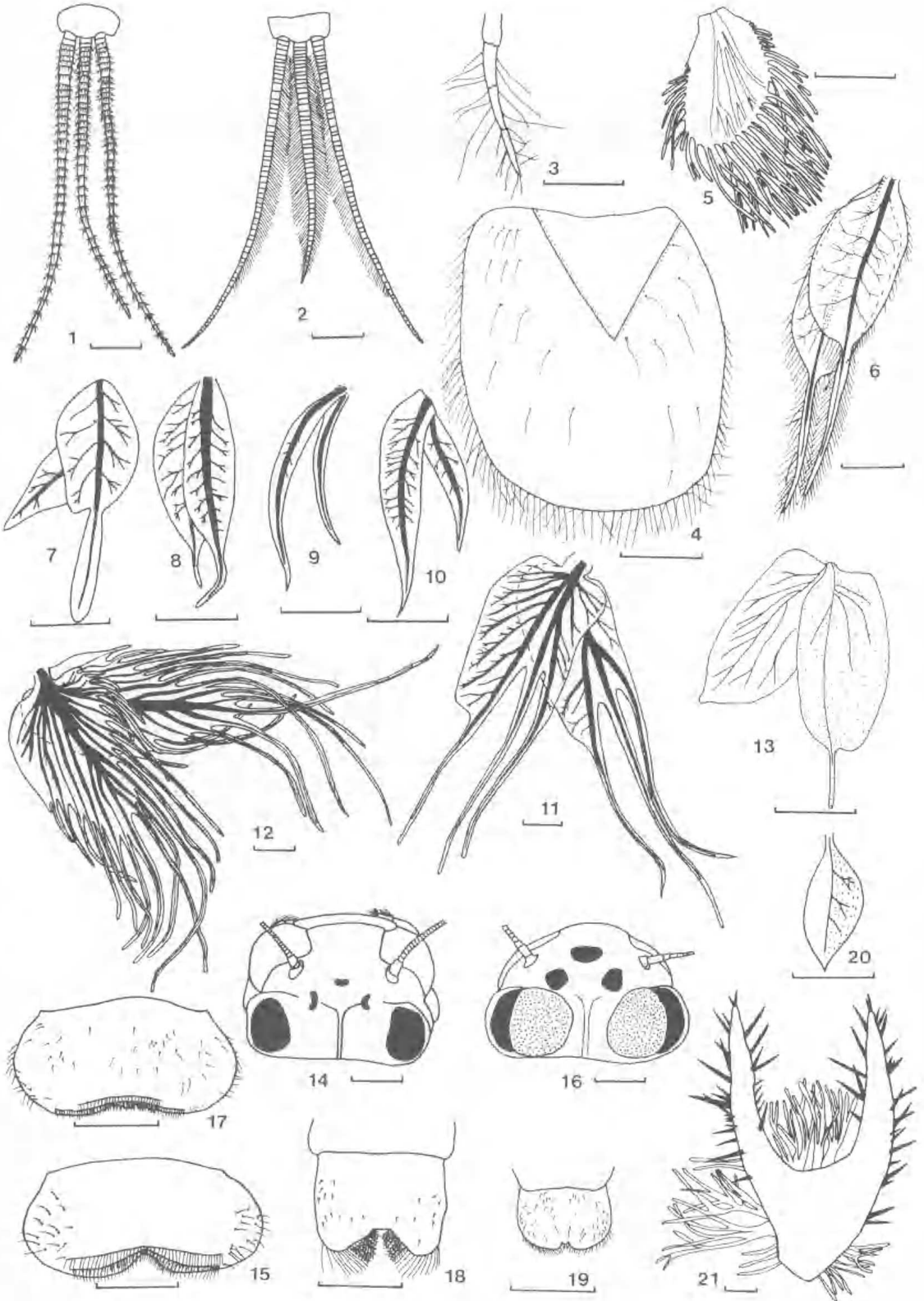
as separate families. Recent reviews of the phylogeny of the Ephemeroptera (Edmunds 1975; Edmunds, Jensen & Berner 1976) also consider these as separate families. This classification (used also by Williams 1968) has been maintained in this paper. The three other families recognised in Australia to date are Leptophlebiidae, Ephemerellidae, and Caenidae.

Four genera in the Leptophlebiidae have been described from adults only and no formal description of nymphal material has been made. These genera are, *Atalomicria* Harker, *Kirrara* Harker, *Thraulophlebia* Demoulin, and *Ulmerophlebia* Demoulin. Of these all except *Thraulophlebia* have been included in a study of adult and nymphal morphology and phylogeny by Tsui & Peters (1975), and nymphs of two (*Atalomicria* and *Kirrara*) have been illustrated but not described by Riek (1970). Therefore, these genera cannot be incorporated in this key, but a mention of the characteristics which distinguish them, as illustrated by Riek, is included.

Atalomicria nymphs "have conspicuous, greatly elongated maxillary palpi" (Riek 1970) which extend well beyond the front of the head, and in *Kirrara* "the abdominal gills have ventral lobes which combine to form a large suction disc" (Riek 1970).

A résumé of the five families of Australian mayflies is included here. The number of species mentioned refers to published material. There are undoubtedly numerous as yet unde-

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scribed species (cf. Riek 1970), but these cannot be included until formal descriptions are published.

Key to the genera of mature Australian mayfly nymphs

1. Head prognathous, thorax and abdomen dorso-ventrally flattened, caudal filaments with whorls of setae at apex of each segment (Fig. 1); Leptophlebiidae, Caenidae, and Ephemerellidae 2
- Head hypognathous, thorax cylindrical (abdomen may be dorso-ventrally flattened), inner margin of lateral caudal filaments and both lateral margins of central filament fringed with long setae (Fig. 2) Siphonuridae and Baetidae 7
2. Prominent double row of spines dorsally on abdomen, 5 pairs of sub-ovate gills on abdominal segments 2-6; Ephemerellidae *Austremrella*
Without double row of dorsal spines on abdomen, gills on abdominal segments 1-5, 1-6 or 1-7 3
3. Seven pairs of paired gills inserted laterally on abdomen, sometimes linear, lanceolate, or broad and multidigitate; Leptophlebiidae 4
- Five or 6 pairs of gills, first a short single filament (Fig. 3), second enlarged, forming an elytriform gill cover (Fig. 4), covering remaining pairs which bear long tracheal filaments (Fig. 5); Caenidae *Tasmanocoenis*
4. Gills broadly ovate with an apical filament on each lamina, long fine setae covering gill surface (Fig. 6), legs with long fine setae, 2 tusk-like projections arising from front of head present or absent *Jappa*
Gill surface without long fine setal covering, legs without long fine setae, head without frontal tusks 5
5. Gills linear-lanceolate, sometimes broadly so (Figs. 7, 8, 9, 10) 6
Gills broad, apex of each gill lamella subdivided with one, 3 or multi tracheal filaments (Figs. 11, 12, 13) *Atalophlebia*
6. Postero-lateral spines on abdominal segments 4-9, spines progressively larger posteriorly, mandibles and maxillae laterally exposed producing broad angular head (viewed dorsally) (Fig. 14) with frontal width greater than width at posterior margin, labrum with deep U-shaped median notch (Fig. 15) *Atalophlebioides*
Postero-lateral spines on abdominal segments 6-9, spines progressively larger posteriorly, mandibles and maxillae held beneath head such that front of head is rounded (Fig. 16) with frontal width narrower than width at posterior margin *Atalanella*
7. Hind corners of abdominal segments not produced into backward pointing spines, head hypognathous, labrum with square median notch; Baetidae 8
- Hind corners of abdominal segments produced into backward pointing spines, labrum entire or with broad median U-shaped notch, head hypognathous; Siphonuridae 12
8. Gill lamellae double on abdominal segments 1-6, seventh gill single, hind wing pad absent *Cloeon*
Gill lamella single on abdominal segments 1-7 9
9. Labrum square, with deep V-shaped median notch, with pair of teeth at apex of indentation (Fig. 18), tarsal claws long and slender, half as long as tarsi *Centropilum*
Labrum oval, with shallow square median notch (Fig. 19), tarsal claws short, less than one quarter tarsal length 10
10. Gills pointed with trachea on one half of median line only (Fig. 20) *Bungona*
Gills ovoid with trachea branched over entire lamella 11
11. Metathoracic wing pads absent in mature nymphs *Pseudocloeon*
Metathoracic wing pads present *Baetis*
12. Four pairs of gills, first pair elytriform covering last 3 pairs *Tasmanophlebia*
Seven pairs of gills present 13
13. Gills deeply bifid and strongly spinose (Fig. 21), thorax strongly humped *Coloburiscoides*
Gills lamellate, not deeply bifid or spinose, thorax weakly humped 14
14. Gills lamellate, first 2 pairs small, with tufts of fibrils situated posteriorly near base, mandibles with long slender incisors, maxillae without long curved apical spines (carnivorous) *Mirawara*
Gills simple lamellate structures; mandibles with single broad incisor, maxillae without long curved apical spines *Ameletoides*

Figs. 1-21. 1, caudal filaments of *Atalanella*; 2, caudal filaments of *Baetis*; 3, 4, 5, first, second and third gill respectively, of *Tasmanocoenis illyardi*; 6, third gills of *Jappa*; 7, 8, 9, gills of *Atalanella*; 10, gill of *Atalophlebioides*; 11, third gill of *Atalophlebia australis*; 12, third gill of *A. australis*; 13, third gill of *A. longicaudata*; 14, dorsal view of head of *Atalophlebioides* (♀); 15, labrum of *Atalophlebioides*; 16, dorsal view of head of *Atalanella* (♂); 17, labrum of *Atalanella*; 18, labrum of *Centropilum*; 19, labrum of *Baetis*; 20, gill of *Bungona narilla* (after Harker 1957); 21, gill of *Coloburiscoides*. Scale lines 0.5 mm.

Family LEPTOPHLEBIIDAE

Nymphs large, slender, dorso-ventrally flattened with prognathous head, maxillary and labial palps 3-segmented. Abdominal segments 1-7 bear lateral gill; three long caudal filaments with whorls of short setae at apex of each segment.

The nymphs are found in most permanent freshwater habitats from standing waters to fast flowing streams.

The Leptophlebiidae is the dominant mayfly family in Australia with 43 described species in eight genera. Of the 43 species only 16 are described from both adult and associated nymphs. A list of the genera and the number of described species is included, while the number of species which have both adult and nymph descriptions are distinguished by parentheses.

Atalophlebia Eaton 1881 18 (10) species described.

Atalonella Needham & Murphy 1924 7(3) species described.

Atalophlebioides Phillips 1930 9 (3) species described.

Atalomieria Harker 1954 2 (0) species described.

Jappa Harker 1954 2 (1) species described.

Kirrara Harker 1954 3 (0) species described.

Thraulophlebia Demoulin 1955 1 (0) species described.

Ulmerophlebia Demoulin 1955 1 (0) species described.

Family CAENIDAE

Small brown nymphs, dorso-ventrally flattened, head prognathous, thorax robust. Abdomen short with gills on segments 1-5 or 1-6. First segment with pair of single filamentous gills, second segment with an enlarged elytriform gill cover, covering remaining pairs which bear long tracheal filaments. Hind corners of abdominal segments produced into small backward pointing projections, and there are three caudal filaments with whorls of short setae at apex of each segment.

The nymphs are found on the undersurface of rocks and wood on the bottom of ponds and standing pools, as well as in slow to moderately fast flowing streams.

Only one genus is recorded in Australia.

Tasmanocoenis Lestage 1930, 3 (2) species described.

Family EPHEMERELLIDAE

Nymphs lacking gills from one or more of segments 1-7. Only a single nymph and a few adult females have been recorded from Australia (Riek 1963). The generic characteristics of *Austremerella* are after Riek (1963). "Paired abdominal gills on segments 2-6, the first pair not modified into opercula. A double row of tubercles on all abdominal segments. Femora and tibiae flattened with a median longitudinal ridge on the upper surface. Vertex of head with a pair of tubercles." (Riek 1963).

Only one genus is recorded in Australia.

Austremerella Riek 1963, 1 (1) species described.

Family BAETIDAE

Nymphs small and slender with cylindrical thorax, and slightly dorso-ventrally flattened abdomen. Head hypognathous, labrum with square median notch on anterior margin. Gills on abdominal segments 1-7, plate like, hind corners of abdominal segments usually not produced into backward pointing projection, if so, only small projections present. Abdomen with three caudal filaments, inner margins of lateral filaments and both lateral margins of central filament fringed with long setae.

The nymphs are common in riffle sections of rocky streams but may be found "amongst the water-weeds of ponds, dams and slow flowing streams and backwaters" (Riek 1970).

There are 12 described species in five genera.

Baetis Leach 1815 5 (3) species described.

Centroptilum Eaton 1869 1 (1) species described.

Cloeon Leach 1815 4 (1) species described.

Pseudocloeon Klapálek 1905 1 (0) species described.

Bungona Harker 1957 1 (1) species described.

Family SIPHLONURIDAE

Nymphs with cylindrical bodies, head hypognathous, labrum entire, or with broad median U-shaped notch on anterior margin. Gills on abdominal segments 1-4 or 1-7. Hind corners of abdominal segments produced into large backward pointing projections. Abdomen with 3 caudal filaments, inner margin of lateral filaments and both lateral margins of central filament fringed with long setae.

The nymphs are usually strong swimmers found in "rapidly flowing, clear cold water

streams, but some species occur in small sub-alpine lakes" (Riek 1970) and backwaters of lowland streams.

There are 10 species described in four genera.

Ameletoides Tillyard 1933 1 (1) species described.

Tasmanophlebia Tillyard 1921 3 (3) species described.

Coloburiscoides Lestage 1935 3 (2) species described.

Mirawara Harker 1954 3 (1) species described.

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